REMARKS

This reply is filed in response to the office action dated November 14, 2008. Claims 1-12, 14-18, 23-74, 81, and 82 are presented for examination.

Rejections under 35 U.S.C. §103(a)

The Examiner rejected claims 1-12, 14-18, 23-42, 53-62, 64-69, 81, and 82 under 35 U.S.C. §103(a) as being obvious over Scher et al. U.S. Patent 6,878,871 ("Scher") in view of Sariciftci et al., U.S. Patent 5,331,183 ("Sariciftci").

Claims 1-12, 14-18, 23-42, 53-62, 64-69, 81, and 82 require photovoltaic cells containing a mesh electrode and a photoactive layer containing a fullerene and a polymer. In making the rejection, the Examiner asserted that

> "It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the photovoltaic cell of Scher et al. by using fullerene as taught by Sariciftci et al. in place of the nanocrystals for the electron acceptor material, because Sariciftci et al. teaches using fullerene would have advantages in cost reduction, simplifying the fabrication procedures and enabling a continuous manufacturing process and fabricating of large area solar cells." *See* the office action, the paragraph bridging pages 4-5.

Applicant respectfully disagrees. Scher describes photovoltaic cells having a nanocrystal component in the photoactive layer. *See*, e.g., the abstract and column 3, lines 10-16. The nanocrystal component contains at least two inorganic materials (or two populations of nanostructures), one of the two inorganic materials including an n-type semiconductor (i.e., an electron acceptor material) and the other including a p-type semiconductor (i.e., an electron donor material) such that these two inorganic materials exhibit a type II band offset energy profile. *See*, e.g., column 7, lines 1-10. Scher does describe using a conductive polymer component in its photovoltaic cell, but the polymer component is optional and is not part of his photoactive material. *See* Scher, column 17, lines 10-24. Rather, the polymer component described in Scher is used as a hole carrier material in the form of a hole carrier layer that is distinct from his photoactive material. *Id.* Thus, Scher's photoactive material is specifically formed of at least two inorganic materials, and his photoactive material does not include a polymer. By contrast, the photovoltaic cell described in Sariciftci uses a fullerene as an electron

acceptor material and a semiconducting polymer as the electron donor material in the photoactive layer. *See*, e.g., the Abstract. Thus, Saricifti's photoactive material is formed of two different organic materials and does not involve an inorganic material.

The Examiner contends that it would have been obvious to replace the nanocrystal component described in Scher (i.e., a combination of electron donor and acceptor materials) with the fullerene described in Sariciftci (i.e., a single electron acceptor material). However, because a type II band offset energy profile is only exhibited in a heterojunction between p-type and n-type semiconductor materials (i.e., electron donor and acceptor materials), the fullerene described in Sariciftci would not exhibit such a type II energy profile by itself. Thus, one skilled in the art would not have wanted to substitute a fullerene described in Sariciftci for the two inorganic materials described in Scher because it would result in photovoltaic cells containing a material that does not exhibit type II band offset energy profile. In other words, such a combination would not achieve the object described in Scher.

Further, Scher teaches using inorganic semiconductor materials in the photoactive layer to absorb light and generate excitons. Specifically, Scher teaches that "[w]hen light (as indicated by arrow 112) impinges upon the nanocrystal component 104, it creates an exciton which passes a hole (θ) into the polymer matrix [106], and conducts the electron (e-) along the nanocrystal 104 ...." *See*, e.g., column 14, lines 59-63. This passage clearly indicates that the incident light is absorbed by the nanocrystal. By contrast, as discussed in Applicant's response filed on October 17, 2008, in polymer-fullerene photovoltaic cells (such as those described in Sariciftci), fullerene has only weak visible light absorption. *See* page 15, last paragraph. Thus, one skilled in the art would not have wanted to replace the inorganic nanocrystal in the photovoltaic cells described in Scher with the fullerene described in Sariciftci because the results would be photovoltaic cells that only have weak visible light absorption and therefore low efficiencies.

In sum, one skilled in the art would not have wanted to combine Scher with Sarciftci in the manner indicated by the Examiner to provide the photovoltaic cells required by claims 1-12, 14-18, 23-42, 53-62, 64-69, 81 and 82. Thus, claims 1-12, 14-18, 23-42, 53-62, 64-69, 81 and 82 are not obvious over Scher in view of Sarciftci. Accordingly, Applicant request reconsideration and withdrawal of this rejection.

Further, claim 82 is not obvious over Scher over Sariciftci on at least one additional, independent ground. Specifically, claim 82 covers photovoltaic cells containing <u>a printed mesh electrode having a maximum thickness of at most about 10 microns</u>. The small thickness of the mesh electrode is resulted from the printing process used to manufacture the mesh electrode. Neither Scher nor Sariciftci discloses or renders obvious such photovoltaic cells.

The Examiner asserted that

> "[r]egarding claim 82, Scher et al. teaches a thickness of a metal electrode is approximately 200 nm (See col. 43, lines 5-10). Therefore it would have been obvious to one skilled in the art that the mesh electrode of Scher et al. can have a thickness of 200 nm, or in the range of a maximum thickness of at most about 10 microns." *See* the office action, page 9, 2nd paragraph.

Applicant respectfully disagrees. Scher describes in the passage cited by the Examiner forming an aluminum cathode by evaporation, <u>not</u> by printing as required by claim 82. Further, the aluminum cathode resulted from the evaporation process above is in the form of a film, <u>not</u> in the form of a mesh as also required by claim 82. In other words, Scher at most describes forming an electrode in the form of a film having a thickness of about 200 nm, but does not disclose or render obvious <u>a printed mesh electrode having a maximum thickness of at most about 10 microns</u> as required by claim 82. Indeed, although Scher mentions photovoltaic cells having a mesh electrode (see, e.g., column 32, lines 43-57 and Figure 7), it is entirely silent on the thickness of the mesh electrode. Note that Scher states that "by using thin <u>foils</u> of these conductive layers [i.e., mesh electrodes], one can maintain the flexibility of the overall device." See column 32, lines 49-50, emphasis added. It appears that Scher suggests forming a mesh foil first and then disposing the mesh foil into a photovoltaic cell to form an electrode. It is well known in the art that a mesh foil typically has a thickness significantly larger than about 10 microns recited in claim 82. Finally, the secondary reference Sariciftci is also entirely silent on the thickness of its electrodes. Thus, neither Schar nor Sariciftci discloses or renders obvious <u>a printed mesh electrode having a maximum thickness of at most about 10 microns</u> as required by claim 82. Therefore, claim 82 is not obvious over Scher in view of Sariciftci on this additional, independent ground.

The Examiner rejected claims 43-52 and 70-74 under 35 U.S.C. §103(a) as being obvious over Scher in view of Sarciftci and further in view of Chapin et al., U.S. Patent 2,780,765

("Chapin"). The Examiner rejected claim 63 under 35 U.S.C. §103(a) as being obvious over Scher in view of Sarciftci and further in view of Griffin, U.S. Patent 3,442,007 ("Griffin").

Claims 43-52, 63, and 70-74, as amended, require photovoltaic cells containing a mesh electrode and a photoactive layer including a fullerene and a polymer. As discussed above, one skilled in the art would not have wanted to combine Scher with Sarciftci to provide such photovoltaic cells. Chapin describes a photovoltaic cell containing monocrystalline silicon with a p-n junction. *See*, e.g., claim 1 and column 2, lines 28-30. Griffin describes affixing a collector grid on the barrier of a cadmium sulfide solar cell. Similar to Scher, neither Chapin nor Griffin teaches or even suggests using a fullerene in a photovoltaic cell. Thus, one skilled in the art would not have combined Chapin or Criffin with Scher and Sarciftci to provide the photovoltaic cells required by claims 43-52, 63, and 70-74. Even if these four references were combined, the results would not have been the photovoltaic cells required by these claims. Accordingly, Applicant requests reconsideration and withdrawal of these two rejections.

Double patenting rejection

The Examiner provisionally rejected claims 1-12, 14-18, 23-74, 81, and 82 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-39 of co-pending Application No. 11/033,217 in view of Scher. Applicant requests that this rejection be held in abeyance until the pending claims are otherwise in condition for allowance.

Please apply any other charges to deposit account 06-1050, referencing Attorney's Docket No. 15626-0006001.

Respectfully submitted,

Date: January 5, 2009

/Tony Zhang/
Tony Zhang, Ph.D.
Reg. No. L0256

Fish & Richardson P.C.
Citigroup Center - 52nd Floor
153 East 53rd Street
New York, New York 10022-4611
Telephone: (212) 765-5070
Facsimile: (212) 258-2291

22074194.doc